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Eng 4

THE

ELECTRIC TELEGRAPH:

WAS IT INVENTED BY

PROFESSOR WHEATSTONE?

BY

WILLIAM FOTHERGILL COOKE, ESQ.

> "A frequently renewed and still unsettled controversy has arisen upon the point of who is to be considered the first contriver of the Telegraph in the form which made it available for popular use."
>
> QUARTERLY REVIEW for June 1854.

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IN THE PRESS,

In one Volume, Illustrated by numerous Plates,

DOCUMENTS RELATING TO THE INVENTION OF THE ELECTRIC TELEGRAPH.

EDITED BY

WILLIAM FOTHERGILL COOKE, ESQ.

THE ELECTRIC TELEGRAPH,

&c.

Those whose interest in the Electric Telegraph is lively enough to induce them to read the statement of facts contained in the following pages, need scarcely be informed, that the unwearied invisible messenger, now employed daily and nightly, by land and by water, in carrying the despatches of commerce and war to every corner of Europe, was first brought into the service of mankind by an invention for which an English patent was granted to William Fothergill Cooke and Charles Wheatstone, on the 12th June, 1837. America and Germany may have since put forth claims to the honour of the discovery, and some notes and hints in anticipation of it may have been brought together, within the last few years, from various parts of the world, to gratify the curiosity excited by its success; but no account of a practical Electric Telegraph, published or written at a date earlier than that of the specification of the patent of June 1837, has yet been produced.

It has been supposed by many persons that this invention of the Electric Telegraph, in the year 1837, was the result of a lengthened process of investigation and experiment on the part of the eminent Professor named in my title page, aided towards the end of his labours by a partner, variously misrepresented as the capitalist, the mechanic, or the man of business, with whom he is understood to have associated himself just before taking out his patent. Documents are now in the press which will tell a very different tale; documents which were already in print thirteen years ago, and of which a copy has remained in Professor Wheatstone's possession ever since. They will convince the most prejudiced, that it was not from his philosophical information, nor from his experimental ingenuity, that Professor Wheatstone acquired his position as one of the patentees of the first practical Electric Telegraph; but from a communication made to him in confidence by the writer, who was then completing the practical invention, and was about to take out a patent for it; who was in possession of practical Electric Telegraphs already made by him, and fit for practical use; who had worked out into a pamphlet a detailed practical system of electric telegraphing; who was in negotiation with a railway company for the practical application of the invention upon their line; and who, having consulted Professor Wheatstone (before the Professor had done anything practical at all) as a scientific man, on a scientific question affecting the proportions of part of the apparatus, and having tried experiments with him upon the point submitted for his advice, was induced, by the adviser's scientific acquirements, and by pecuniary considerations, to admit him to a share in the patent, as second partner. I may just mention by the way, that I was not a capitalist, nor a mechanic, nor a man of business, but a military man, lately returned from service in India, and wholly inexperienced in patents and business arrangements, to which, on the other hand, my scientific coadjutor was already accustomed.

It was at the end of February, 1837, that I consulted Mr. Wheatstone; and the patent was completed, as already mentioned, in the following June. Very soon afterwards, I arranged and put up an experimental telegraph to Camden Town, for which the Engineer and Directors of the London and Birmingham Railway Company had given an order, after witnessing a series of experiments, which we had tried at Euston Station by their permission, obtained through the influence of my friends. The invention at once became a subject of public interest; and I found that Mr. Wheatstone was talking about it everywhere in the first person singular. I remonstrated with him. I cautioned him as a friend that he was getting himself into a false position.

At length, in 1840, I required that our positions, relatively to the invention and to each other, should be ascertained by arbitration. Arbitrators of eminent scientific attainments were appointed, by a formal legal instrument, to inquire into the facts and report the result. Elaborate statements were laid before them, and printed for their use. A volume of drawings, illustrating all the several forms and stages of the invention, was prepared and zincographed. The Arbitrators made their Award; Mr. Wheatstone subscribed his assent to it; but scarcely had it been published, when I heard of whispers in scientific circles that it was only a concession to quiet the business partner, and meant nothing. And so completely has it now been explained away, that a recent article in the "Quarterly Review," of evident research and apparent candour, ignores it altogether.

In April, 1841, two men, whose names might have obtained for their lightest opinion a candid consideration, and who are not now living to defend their judgment—the late Sir Isambard Brunel and Professor Daniell—with the fullest means of information before them, found me "*entitled to stand alone*," as the person "*to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking, promising to be a work of national importance.*" Professor Wheatstone deliberately ratified this decision. In June, 1854, the writer of the article in the "Quarterly," without mentioning any discovery, during the interval which has elapsed since the date of the award, of further evidence tending to a different conclusion, pronounces anonymously that Mr. Wheatstone is entitled to stand alone, on the same ground. The Public will judge, when the papers are published, which of the two verdicts is the right one.

My present explanation, however, is not directed against the "Quarterly Review," but against Mr. Wheatstone. His egotism caused the misconception to which the Reviewer has given utterance. He must have seen the article published in June. He knew that it contained statements, in his favour and to my prejudice, contrary to the truth and to his own solemn admission. He might have contradicted these mis-statements in the September number of the Review: by allowing them to remain uncontradicted, he has virtually adopted them.

Nor is this my only charge against him. In the spring of 1843, by a new arrangement then made between us, I became the sole proprietor of the Patents, Mr. Wheatstone receiving, in exchange for his share, the grant of a liberal royalty on all lines of telegraph which should be constructed under them, with a discharge from present claims, and a dispensation from future liabilities. In my character of sole proprietor, I so managed the patents as to make his fortune, within three years after his retirement, by the sale for him on his own terms of the royalty reserved in his favour. On the sale of the patents to the Electric Telegraph Company in 1845, I made arrangements for his scientific connexion with the undertaking on a footing alike honourable and remunerative; a connexion which he himself terminated, in consequence of annoyances attributable to his own indiscretion (or perhaps misfortune), in his dealings with other inventors. Yet, after all this, he has allowed his friends to give out that, on the sale to the Telegraph Company, he was induced to part with his share in the patents at an inadequate price, under conditions by which the further exercise of his inventive talents was jealously prohibited.

He has perhaps inferred, from my long-continued silence, that no amount or repetition of provocation would induce me to come forward; or he has forgotten the contents of the arbitration papers. If my readers should be persuaded to follow me into the volume of documents which I am about to publish, they will be only less surprised at my forbearance, than at the hardihood which has worn it out. For thirteen years, with the means of self-protection in my hands, I have allowed myself to be deprived, in the estimation of many persons whose good opinion I value, of the credit justly due to the origination of one of the great inventions of the age. I have remained quiet under misconceptions, always humiliating, sometimes even obstructive in business. The errors of the article in the " Quarterly Review " are only a reproduction, in a mitigated form, of misstatements which I have passed over in fifty inferior publications. But I yield at length to the urgent representations of friends, who have interested themselves in the invention, and watched its progress, from the commencement; and in justice to those friends themselves, as well as to my family and connexions—to the high character of the Periodical which has been misled, and to the honoured memory of the Arbitrators — I shall no longer hesitate to make public the overwhelming body of evidence which I have hitherto so patiently held back; avoiding, as far as possible, anything like a personal attack upon Mr. Wheatstone, though I cannot spare him the humiliation of retiring from a position, in which he ought never to have allowed himself to be placed.

Whether I am to throw the blame on the indiscreet partiality of his friends, or on his own scientific prejudices, or want of memory or of candour, it is evident, as a matter of fact, that he has possessed himself of the whole credit of having originated the Practical Electric Telegraph, for which we took out the Patent in June 1837; though he knows and has admitted that I was the originator of it.

He has also caused or permitted a misrepresentation of the business arrangements of 1843 and 1845.

These being the two points on which I consider that he has compromised himself—the two charges, if I may so call them, which I have to prove; I shall proceed, without further preface, to extract from the article in the "Quarterly Review," above referred to, some portions of the erroneous statements which have induced me to lay my counter-statement before the Public. I shall next give the substance of the deed of reference under which the above-mentioned arbitration took place; and shall then set out the Award and Mr. Wheatstone's assent to it. These will lead me to explain the nature of the documents on which the Arbitrators founded their decision, and which are now in the press; and to give some extracts for the information of readers who may not have access to my larger publication. Having thus given a sketch of the evidence by which my first charge is made out, I shall pass on to a statement, in support of my second charge, of the circumstances under which Mr. Wheatstone's share in the Patents was assigned to me in the year 1843; of the arrangements made two years afterwards for the sale of his royalty on the formation of the Electric Telegraph Company; of his appointment as the Company's scientific adviser; and his resignation of that appointment.

To begin then with some extracts from the article in the "Quarterly."

"A frequently renewed and still unsettled controversy has arisen upon the point of who is to be considered the first contriver of the Telegraph in the form which made it available for popular use. Two names alone are now put forward to dispute the claim with Wheatstone—Steinheil of Munich and Morse of New York. From a communication of M. Arago to the French Academy of Sciences, it appears that the Telegraph of Steinheil was in operation, for a distance of seven miles, on the 19th of July, 1837, the same month in which Wheatstone put his own contrivance to the test upon the North Western Railway. But besides that the Patent of Wheatstone was taken out in the preceding June, and was itself founded upon previous and thoroughly successful experiments, there is another material circumstance which gives him a claim to priority over Steinheil, viz., that the latter published no description of his instrument until August, 1838, that he altered and improved it in the interval, and that the only accounts we have of his contrivance describe its amended and not its original form. It was, however, a very meritorious performance, and, in addition to its other excellences, Steinheil was the first who employed the earth to complete the circuit—a most important fact, which we shall explain hereafter. Still his Telegraph was inferior in its mechanical arrangements to that of Wheatstone, and the inventor himself soon abandoned it in favour of a modification of the instrument of Morse."—Pp. 125-6.

" The question of priority is, in our opinion, after all of no sort of importance, at least as regards the rival claims of Wheatstone and Steinheil. When the progress of science has prepared the way for a great discovery, two geniuses will occasionally take the step together, because each is able to take the step of a giant. It was thus that the Calculus was found out by both Newton and Leibnitz, and the place of Neptune in the heavens by both Adams and Leverrier. It was the same with the Telegraph. The investigations of Wheatstone and Steinheil were entirely independent of each other, and it cannot lessen the merit of either that there was a second man in Europe who was equal to the task.

"There are some who dispute Professor Wheatstone's claim, by urging that, inasmuch as all the main features of the Telegraph existed before he took out his Patent, there was nothing left to invent. It is true that much had been done, but it is equally certain that there was much to do. When Wheatstone first directed his attention to electricity as a means of communicating thoughts to a distance, the telegraph was a useless and inoperative machine. He and his partner established as a working, paying fact what had hitherto been little better than a philosophic toy. To those who now disparage the Professor's labours we think it sufficient to reply by the admirable saying of the French *savant*, M. Biot—'Nothing is so easy as the discovery of yesterday; nothing so difficult as the discovery of to-day.'"—Pp. 126-7.

I will now make some extracts from the deed of reference.

"ARTICLES of AGREEMENT made this 16th day of November 1840, between WILLIAM FOTHERGILL COOKE, - - - Esq., of the one part, and CHARLES WHEATSTONE, - - - Esq., of the other part.

"WHEREAS the parties hereto are the co-proprietors of certain English, Scotch and Irish patents granted to them, or one of them, in and since the year 1837, for an Invention commonly called the "Electric Telegraph," and for improvements thereon: And whereas the said William Fothergill Cooke having represented to the said Charles Wheatstone that he the said W. F. Cooke, has been subjected to constant annoyance and serious injury by alleged erroneous notions, which have been (as he states) generally received of his position relative to the said C. Wheatstone, in consequence of alleged erroneous statements, alleged to have been contained in a long series of widely circulated publications; It has therefore been agreed between the parties hereto, upon the said W. F. Cooke's application, that the relative positions of the said parties should be ascertained by arbitration as hereinafter mentioned."

After mentioning a second subject of reference which has ceased to be of any importance, the deed proceeds :—

"Now these presents witness, that in consideration of the premises, it is hereby mutually agreed between the said parties hereto, as follows; that is to say—

"First, That Marc Isambard Brunel, of the Thames Tunnel, London, Esq., shall be arbitrator on behalf of the said W. F. Cooke; and John Frederick Daniell, of Norwood, Surrey, Professor of Chemistry in King's College, London, arbitrator on behalf of the said C. Wheatstone, for the purposes hereinafter mentioned."

The second clause contains a power, which was not exercised, of appointing a third arbitrator; and the deed then states the principal subject of reference, in the following terms :—

"Thirdly. That the Arbitrators shall, with all convenient expedition, ascertain the relative positions of the said parties hereto, in the following manner, namely: The arbitrators shall investigate, and they or any two of them shall conclusively determine by their written award, in what shares, and with what priorities and relative degrees of merit, the said parties hereto are co-inventors of the Electric Telegraph; due regard being paid to the original projection thereof; to the developement of its laws and properties; to the practical introduction of it into the United Kingdom; to the improvements made upon it since its introduction there; and to all other matters which the arbitrators, or any two of them, shall in their discretion think deserving of their consideration."

Then follow various powers and formal clauses; the signatures and seals of the parties; and the attestations of their solicitors.

Five months after the date of the above deed of reference, viz. on the 27th April, 1841, Sir Isambard Brunel and Professor Daniell made their Award as follows:—

"As the Electric Telegraph has recently attracted a considerable share of public attention, our friends, Messrs. Cooke and Wheatstone, have been put to some inconvenience, by a misunderstanding which has prevailed respecting their relative positions in connexion with the invention. The following short statement of the facts has, therefore, at their request, been drawn up by us the undersigned Sir M. Isambard Brunel, Engineer of the Thames Tunnel, and Professor Daniell, of King's College, as a document which either party may at pleasure make publicly known.

"In March, 1836, Mr. Cooke, while engaged at Heidelberg in scientific pursuits, witnessed, for the first time, one of those well-known experiments on electricity, considered as a possible means of communicating intelligence, which have been tried and exhibited from time to time, during many years, by various philosophers. Struck with the vast importance of an instantaneous mode of communication, to the railways then extending themselves over Great Britain, as well as to government and general purposes, and impressed with a strong conviction that so great an object might be practically attained by means of electricity, Mr. Cooke immediately directed his attention to the adaptation of electricity to a practical system of Telegraphing; and, giving up the profession in which he was engaged, he, from that hour, devoted himself exclusively to the realization of that object. He came to England in April, 1836, to perfect his plans and instruments. In February, 1837, while engaged in completing a set of instruments for an intended experimental application of his Telegraph to a tunnel on the Liverpool and Manchester Railway, he became acquainted, through the introduction of Dr. Roget, with Professor Wheatstone, who had for several years given much attention to the subject of transmitting intelligence by electricity, and had made several discoveries of the highest importance connected with this subject. Among these were his well-known determination of the velocity of electricity, when passing through a metal wire; his experiments, in which the deflection of magnetic needles, the decomposition of water, and other voltaic and magneto-electric effects, were produced through greater lengths of wire than had ever before been experimented upon; and his original method of converting a few wires into a considerable number of circuits, so that they might transmit the greatest number of signals, which can be transmitted by a given number of wires, by the deflection of magnetic needles.

"In May, 1837, Messrs. Cooke and Wheatstone took out a joint English patent, on a footing of equality, for their existing inventions. The terms of their partnership, which were more exactly defined and confirmed in November, 1837, by a partnership deed, vested in Mr. Cooke, as the originator of the undertaking, the exclusive management of the invention, in Great Britain, Ireland, and the Colonies, with the exclusive engineering department, as between themselves, and all the benefits arising from the laying down of the lines, and the manufacture of the instruments. As partners standing on a perfect equality, Messrs. Cooke and Wheatstone were to divide equally all proceeds arising from the granting of licenses, or from sale of the patent rights; a per-centage being first payable to Mr. Cooke, as manager. Professor Wheatstone retained an equal voice with Mr. Cooke in selecting and modifying the forms of the telegraphic instruments, and both parties pledged themselves to impart to each other, for their equal and mutual benefit, all improvements, of whatever kind, which they might become possessed of, connected with the giving of signals, or the sounding of alarums, by means of electricity. Since the formation of the partnership, the undertaking has rapidly progressed, under the constant and equally successful exertions of the parties in their distinct departments, until it has attained the character of a simple and practical system, worked out scientifically on the sure basis of actual experience.

"Whilst Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the Electric Telegraph as a useful undertaking, promising to be a work of national importance; and Professor Wheatstone is acknowledged as the scientific man, whose profound and successful researches had already prepared the public to receive it as a project capable of practical application; it is to the united labours of two gentlemen so well qualified for mutual assistance, that we must attribute the rapid progress which this important invention has made during the five years since they have been associated.

M^{C} I^{D} BRUNEL.
J. F. DANIELL.

London, 27th April, 1841."

Before the signature of this Award, the draft of it had been handed to Professor Wheatstone for consideration, and, by his request, the particulars of his earlier experiments, as they now stand, had been added to the original form in his own words. To the Award thus amended, and which, being made by agreement, was a treaty as well as a decision,* Professor Wheatstone, under the advice of his able and experienced legal adviser, followed me in subscribing a cordial and grateful assent as follows :—

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* I cannot better illustrate the real nature of the Award, than by printing a letter which I wrote to Mr. Wheatstone's arbitrator, Professor Daniell, on the day before the final meeting of the 27th of April. The parts omitted have no bearing upon the question of invention.

Kidbrooke Lodge,
26th April, 1841.

"DEAR SIR,

You have no doubt received a letter which I wrote to you to-day, requesting that a meeting might take place before Mr. Wheatstone's departure for the Continent, in order that we might at once conclude the basis of an amicable arrangement, and request Mr. Richardson and Mr. Wilson to lose no time in preparing such legal documents as might be necessary, or that we might come to a final understanding that an amicable settlement is unattainable, and without further fruitless negotiations proceed with the arbitration immediately on Mr. Wheatstone's return.

"GENTLEMEN, LONDON, 27th April, 1841.

We cordially acknowledge the correctness of the facts stated in the above document, and beg to express our grateful sense of the very friendly and gratifying manner in which you have recorded your opinion of our joint labours, and of the value of our invention.

We are, Gentlemen,
With feelings of the highest esteem,
Your obedient Servants,
WILL^{M} F. COOKE.
C. WHEATSTONE.

SIR M. ISAMBARD BRUNEL, and
J. F. DANIELL, Esq., Professor, &c. &c."

At the time when the Award was thus made and agreed to, Mr. Wheatstone and myself, our solicitors and the arbitrators, were each of us in possession of a printed book, containing—(1) my Case, or statement of facts: (2) Mr. Wheatstone's Case, or statement of facts: (3) my solicitor's opening address, or summary of evidence: also of a volume of zincographed

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I have since seen Sir I. Brunel, who has kindly agreed to devote any hour to-morrow to the subject.

That the Arbitrators and Mr. Wheatstone may be fully in possession of my views, I now hand you a final statement of what I will, and of what I will not, concede. At the last meeting at which I was present, the Arbitrators expressed strongly their anxiety to promote an amicable settlement. I cordially responded to their wish; and on being requested, as plaintiff, to state what I claimed, I prepared a memorandum for the signature of the Arbitrators and the parties. I there claimed the least which I think I can be expected to accept; and by that memorandum (which I again enclose) I am still willing to abide.

drawings, with printed tables of reference to them. Almost the whole of the original impression of the cases and address was destroyed, by Professor Daniell's desire, to prevent publicity; but a few copies were preserved by the different parties to the enquiry, one of which I am now reprinting,† with the drawings, and my early pamphlet on the Electric Telegraph.

My statement of the facts, so far as they remain material, was shortly as follows :—Having returned

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Professor Wheatstone has adopted the greater portion of it, but he has transposed the paragraphs, so as to give precedence to his name. To this I cannot consent, as his connexion with the practical undertaking commenced (even by his own showing) at a comparatively recent date, and in consequence of my urgent invitation. The scientific field I left open to him in the most liberal spirit. I have, at your suggestion, expressed in different words the idea which I before intended to express by the word "Projector;" and I have also introduced Mr. Wheatstone's summary of his researches, and adopted some others of his expressions.

* * * * * *

I beg that these may be received as my final propositions.

* * * * * *

I am, dear Sir,
Yours very truly,
WILLM F. COOKE.

J. F. DANIELL, Esq."

† The printed papers were placed at the disposal of the Arbitrators, by a written agreement, on that and other points, which was signed by the parties and by the Arbitrators, at the meeting of the 27th of April, immediately after the signature of the Award.

The same agreement threw all the expenses of the arbitration on the Partnership: a condition on which I insisted, as my outlay (including printing, drawing and zincographing) exceeded Mr. Wheatstone's, tenfold.

from India on leave of absence, on account of the state of my health, and afterwards resigned my commission, I was studying anatomy and modelling my dissections at Heidelberg, when, in March, 1836, I happened to witness one of the common applications of electricity to telegraphic experiments, which had been repeated without practical result for half a century. Perceiving that the agent employed might be made available to purposes of higher utility than the illustration of a lecture, I at once abandoned my anatomical pursuits, and applied my whole energies to the invention of a practical Electric Telegraph, which, within three weeks, I accomplished in the telegraph designated "Part B" in the first sheet of the drawings, now in course of publication. I soon afterwards made another Electric Telegraph of a different construction, also shown in the drawings. In the summer of 1836, I worked out an entire practical system of electric telegraphing, in the pamphlet above referred to. In the winter of the same year, I made a conditional arrangement with the Liverpool and Manchester Railway Company, for the erection of an Electric Telegraph in the tunnel at Liverpool. In the following February, when about to apply for a patent, I asked the advice of Dr. Faraday and Dr. Roget on the construction of the electro-magnet employed in part of the apparatus, as explained below. Dr. Roget advised me to consult Professor Wheatstone, which I did on the 27th February, 1837. That Mr. Wheatstone had not yet got beyond the "philosophic toys" of his friend the Reviewer, appears by his own statement of what he had done, in the introductory part of the Award: where his "much" (fruitless) "attention to the subject" "for several years"—the old lecture-room experiments, annually repeated, yet remaining unapplied—his "greater lengths of wire than had ever before been experimented upon;" and his economical key-board, which has never been used—would seem to have been interpolated for no other purpose than to set off, by way of contrast, the practical realities of my "plans and instruments." He eventually joined me in the patent; in which my name took the lead; towards the expense of which he contributed more than half; and which was charged in my favour with £130 for the expenses of my past experiments, without any allowance to Mr. Wheatstone for any past experiments of his. Whereas afterwards, in 1839, when his experiments had mainly led to the completion of materials for a second joint-patent, (supposed at the time to be of value, but which has not come into use,) he asked and obtained priority for his name, and an allowance for his expenses.

Facts thus conclusive in themselves were rendered, if possible, doubly conclusive, by Mr. Wheatstone's attempts to explain them away. In the Case which he laid before the Arbitrators, he imprudently committed himself to a great number of particular statements, about things which had been done, and things which had been said; statements not very material perhaps if well founded, but the incorrectness of which was conclusively proved by documentary and circumstantial evidence. On the one side, was a simple narrative, probable in itself and consistent with circumstances, and supported by documents and instruments, and by the personal knowledge of numerous respectable witnesses: on the other side, a series of plausible but unsupported assertions, all of which were disproved. I venture to say, that no candid person can read my Case without believing it; nor Mr. Wheatstone's Case, with my solicitor's summary of the evidence in answer to it, without full conviction that every material part of the Case is incorrect, and that the answer is beyond the reach of a reply.

A summary of evidence, and more especially one of circumstantial evidence, is in its nature scarcely susceptible of abridgment; nor could extracts of individual instances, of statements inconsiderately made and conclusively answered, convey a just notion of the whole effect of an argument which deals in like manner with a score of such instances besides. Yet, as I cannot expect to persuade any great number of persons to read the documents themselves, I must extract some portions of narrative from my Case, for the information of a class of readers who may be willing to follow me through a pamphlet, but who would be deterred by the expense and bulk of a volume. I will begin by extracting, from the earlier part of my Case, a letter which I wrote to Professor Wheatstone two or three years before the arbitration, as follows :—

"My dear Sir, 22nd August, 1838.

I was surprised to hear this morning that the Association had already met; having anticipated some communication from you before your departure from London, under the supposition that you would introduce the Telegraph to the notice of the *savans* there assembled. I have long been annoyed by the urgent requests of my friends to publish my claims to the invention, but invariably declined; more recently, a well-known scientific personage has been most urgent to bring it forward at the present meeting, but I have refused, for two reasons; first, as I believe an invidious feeling rather than zeal in my cause dictated his offer, but more especially as I prefer leaving my cause entirely in your hands, and thereby evincing my sense of the confidence you have placed in me by entrusting your pecuniary interest in the patent to my honour and control. So great a publicity has been given to the subject, that I cannot doubt it will be made a prominent topic in your section, which will give you the most favourable opportunity of placing the facts briefly before the public in their true light. I believe you have ever considered me as the individual, by whose solitary exertions, for a lengthened period, the system was prepared for practical application, in other words, as the Projector; and I employ your frequently repeated expression in saying that you consider us on an equal footing as inventors. The former post as Projector explains most satisfactorily to the world why my name takes the lead in the patent, without casting the slightest shade over yours as a scientific man. Do, my dear sir, make a point of settling this question in the manner which your own feelings as a gentleman and a man of science will dictate, that it may rest henceforth and for ever: our mutual good understanding, which I trust has been gradually strengthening, will be confirmed by this step. It is finally determined that iron and lead tubing are to be employed only, on the Great Western Railway; a large supply of materials will be ready in a few days, when I expect to proceed rapidly.

Yours faithfully,
WILL^{M} F. COOKE.

C. WHEATSTONE, Esq."

The incident which first turned my attention to the Electric Telegraph, is thus mentioned in the Case:—

"In the month of March, 1836, I was engaged at Heidelberg in the study of anatomy, in connexion with the interesting and by no means unprofitable profession of anatomical modelling; a self-taught pursuit, to which I had been devoting myself with incessant and unabated ardour, working frequently fourteen or fifteen hours a day, for about eighteen months previous. About the 6th of March, 1836, a circumstance occurred which gave an entirely new bent to my thoughts. Having witnessed an electro-telegraphic experiment, exhibited about that day by Professor Möncke, of Heidelberg, who had I believe taken his ideas from Gaüss, I was so much struck with the wonderful power of electricity, and so strongly impressed with its applicability to the practical transmission of telegraphic intelligence, that from that very day I entirely abandoned my former pursuits, and devoted myself thenceforth with equal ardour, as all who know me can testify, to the prac-

tical realization of the Electric Telegraph; an object which has occupied my undivided energies ever since."

Then follows a description of Professor Möncke's experiment, which I will extract, after a few words of general explanation for the benefit of such of my readers as may happen to be unacquainted with the principles on which telegraphing by electricity is founded.

If some pieces of copper and zinc are arranged alternately in a trough, partially filled with acidulated water or wet sand, they form what is called a *voltaic battery;* and if, from the copper at one end, a piece of wire, or *metallic circuit*, is carried for a greater or less distance round to the zinc at the other end, a current of electricity immediately passes through the wire, and continues to flow while the connexion is maintained. If the wire be cut in two, the current instantly ceases to flow; it begins again when the parts are brought together, and so on. Now, for a long time before the invention of the Electric Telegraph, it was well known that if a common magnetic or compass needle were suspended near and parallel to the wire, the passing of the current through the wire would have a tendency, during the continuance of the current, to make the needle change its position, and hang across the wire instead of parallel to it. It was also well known, that this *deflecting* force of the electric current could be *multiplied*, by coiling the wire many times round a space containing the needle; the wire being *insulated* by being covered with a non-conducting material, so as to ensure the passing of the current through the whole length of the wire, without finding a shorter passage across at some point of contact in the coil. And this well-known multiplied deflecting power was in common use, in an instrument called a *galvanometer*, for measuring the force of an electric current.

It was also well known, long before the invention of the Electric Telegraph, (known, that is, to scientific men, for all was new to me,) that if an insulated wire were coiled round a piece of soft iron, the passing of an electric current through the wire would cause the iron to attract other iron like a magnet; the attractive force of this *voltaic* or *temporary* magnet, or *electro-magnet*, ceasing with the cessation of the electric current. But to return to the Case.

"Professor Möncke's experiment was at that time the only one upon the subject that I had seen or heard of. It showed that electric currents, being conveyed by wires to a distance, could be there caused to deflect magnetic needles, and thereby to give signals. It was in a word a hint at the application of electricity to telegraphic purposes; but nothing more, for it provided no means of applying that power to practical uses. His apparatus consisted of two instruments for giving signals by a single needle, placed in different rooms, with a battery belonging to each; copper wires being extended between these two termini. The signals given were a cross and a straight line, marked on the opposite sides of a disc of card, fixed on a straw; at the end of which a magnetic needle was suspended horizontally in galvanometer coils, by a silk thread. The effect of this arrangement was, that if a current was transmitted from either battery, when the opposite ends of the wires were in connexion with the distant telegraphic apparatus, either the cross would be there exhibited by the motion of the needle one way, or the line by its motion the other way, according to the direction of the current. The apparatus was worked by moving the ends of the wires backwards and forwards between the battery and the coils."

The case then proceeds to describe my first Telegraph, as follows:—

"Within three weeks after the day on which I saw the experiment, I had made, partly at Heidelberg and partly at Frankfort, my first Electric Telegraph, of the galvanometer form, which is now at Berne. It has been written for, and shall be laid before the arbitrators. I used six wires, forming three metallic circuits, and influencing three needles. I worked out every possible permutation and practical combination of the signals given by the three needles, and I thus obtained an alphabet of twenty-six signals. I had invented the instrument which I called the DETECTOR; by means of which injuries to the wires, whether from water, fracture, or contact, are readily traced; an instrument which in practice is never out of my hand, and without which the Electric Telegraph would be impracticable. But my principal improvement was, that my Telegraph did not merely send signals from one place to another, but that it was, even at that early period, a *reciprocal telegraphic system*, by which a mutual communication could be practically and conveniently carried on between two distant places; the requisite connections and disconnections being formed by pressing the fingers upon keys, and the signals being exhibited to the person sending, as well as to the person receiving, the communication. This improvement was effected by placing a system of keys permanently at each extreme end of the metallic circuit, and by providing each circuit with a cross-piece of metal for completing the continuity of the wires when signals were being received from the opposite terminus. The two signal apparatuses being thus thrown into the course of the metallic circuit, every signal was given at both ends concurrently; and the cross-piece was made to restore the circuit for a reply, on the first communication being completed. This united and reciprocal property is the basis of the Electric Telegraph, and is inseparable from the practical system. It has been my leading principle throughout, and has impressed itself even upon the forms of my instruments; their distinguishing characteristic from first to last being, that my keys and signals have always been joined together into one instrument, and the several instruments into one reciprocal system. In a word, the Arbitrators will here recognize the earliest form of the RECIPROCAL COMMUNICATOR, the fundamental condition of the Electric Telegraph under every varied mode of its operation."

The Alarum is thus described:

" My earliest apparatus thus comprised, in a complete though improvable form, two essential parts of my system of a Practical Electric Telegraph; viz.: the Detector and the Reciprocal Communicator: a third of equal importance is the ALARUM, without which the Electric Telegraph would require to be constantly watched like ordinary telegraphs.

"Before the end of March 1836, I had invented the Alarum, which is still extant in my first Mechanical Telegraph. It was one of ordinary construction, worked by clockwork mechanism on a removal of a detent. My invention consisted in placing a voltaic magnet in such proximity to an armature of soft iron forming the tail-end of a lever detent, that when an electric current passed round the voltaic magnet, the magnetism which was for the moment excited in it attracted the tail-end of the lever, and by so doing drew its detent-end out of the clockwork; but on the temporary magnetism ceasing with the cessation of the current, the attraction of the tail-end of the lever ceased also, and the detent-end of it was then replaced in the clockwork by a reacting spring or balance weight."

The origin and principle of the "Mechanical Telegraph," referred to in the last extract, are explained as follows:—

"The principle of removing a detent by magnetic attraction, and replacing it by mechanical reaction, was not however confined to the Alarum, but on the contrary it was the basis of my Mechanical Telegraph itself. The first idea of it suggested itself to my mind on the 17th March 1836, during my journey from Heidelberg to Frankfort, when reading Mrs. Somerville's work on the Physical Sciences; and the Arbitrators will find that I immediately afterwards applied the idea to a musical snuffbox, being almost the only piece of mechanism I was then acquainted with. The striking advantage held out by the mechanical, in comparison with the galvanometer form was, that whereas the mode of giving signals by combinations of magnetic needles, each acted upon directly and separately by an electric current, involved the necessity of using several circuits, and consequently the expense of several wires; on the other hand, if the electric agency could be confined to the office of causing suitable interruptions or divisions in any kind of motion derived from an independent source, the necessity of a plurality of circuits would be avoided, for the diversity of the signals would then depend upon the mechanism."

Though some degree of interest may attach to this, the earliest application of temporary magnetism to exhibit visible signals by letting off clock-work mechanism at a distance (for this mode of signalling, whether to the ear or to the eye, was new in principle when I adopted it) the "Mechanical Telegraph," with all its apparent advantages, and notwithstanding the endeavours of ingenious persons to render it available, has not come into use, to any considerable extent at least, in this country. The visible signals are still given by the deflection of magnetic needles, and the electro-magnet is confined in practice to the Alarum.

The narrative is continued to the beginning of 1837, as follows:—

"During the months of June and July 1836, I employed my leisure moments in working out the details of my system into a written pamphlet or sketch, which is extant, and the date of which can be clearly proved. The Arbitrators will learn from it that (as early as July 1836) I had, in anticipation, worked out my practical system from the minutest official details, up to the remote and extended ramifications of an important political and commercial engine.

"Towards the end of 1836, my mechanical instrument was nearly completed, and my funds nearly exhausted. Finding it, therefore, necessary either to turn my invention to an immediate profitable result, or to draw upon the resources of my friends, and preferring the former alternative, I obtained an introduction to several of the leading gentlemen connected with the Liverpool and Manchester Railway, and submitted to them, in January 1837, my pamphlet and mechanical instrument, with a view to the practical adoption of the Telegraph in a tunnel for which some mode of conveying signals was required. The correspondence connected with this, my first endeavour to apply the Electric Telegraph to railways, will be laid before the Arbitrators.*

"Before taking my instrument into the North, I showed

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* This correspondence included a letter from Dr. Reynolds, of Liverpool, which I print as a contemporaneous expression by a scientific man of the general state of opinion as late as January 1837, many years after the commencement of Mr. Wheatstone's experiments, on the subject of telegraphing by electricity:—

"My dear Sir,

I have examined the papers which you sent to me describing the Electro-Magnetic Telegraph. The Author does not explain the mode in which he proposes to apply this power to effect his purpose. There can be no doubt that electricity, from whatever source it may have been derived, can be transmitted to a distance it in November 1836 to Dr. Faraday, who kindly called at my lodgings in the Adelphi for the purpose of looking at it, and encouraged me by an assurance that I was right in principle.

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however great, by means of a copper wire, in a space of time almost imperceptible. Mr. Wheatstone calculates that it travels at the rate of *four million feet in a second.* The electro-magnetic apparatus possesses many advantages over all other methods with which we are acquainted of affording electricity—it is simple in its construction, not liable to be influenced by states of the atmosphere, or to get out of order. Supposing, therefore, that an isolated wire were extended from Liverpool to London, we might transmit electricity from one place to the other with the greatest rapidity and regularity; but how this power or agency can be applied to communicate signals to the extent required, I cannot conceive; and on this point Mr. Cooke is silent, no doubt intentionally, as in this evidently consists the essence of the invention, and he very naturally must wish to secure some advantage from his discovery, before making it public. He appears to have bestowed much thought and labour on the subject; and some of his contrivances are very ingenious. I was particularly struck with his mode of detecting the defective place, should the wire be broken at any part—it is for this purpose that he makes use of the index or dial given in his book. He appears to me, however, to under-rate the practical difficulties of maintaining a wire extending for many hundred miles, in a state of perfect integrity and electrical isolation; and unless he has two wires of communication, he would, I conceive, be liable to the inconvenience of the parties at each extremity signalizing at the same moment of time, and the effect being thus destroyed.

Should you feel any wish to see an electro-magnetic machine, I have one at the Institution, which I should have much pleasure in exhibiting to you.

I am, my dear Sir,
Very truly yours,
Wm. M. REYNOLDS.

Bedford Street, 26th January, 1837.
Jos. N. Walker, Esq., Calderstone."

“The Directors of the Railway Company thought my instrument, which was calculated to give 60 signals, of too complex a nature for the purpose of conveying a few signals along a tunnel; and therefore proposed that I should arrange one adapted for their purpose. I immediately designed and drew the second form of the mechanical telegraph, which was based upon the same principles as the first, but being calculated to give fewer signals was less complex. I returned to London immediately afterwards, and directed four instruments of the simpler form to be begun; which were soon afterwards made, and are extant. I had two of them working together at the close of April 1837.”

The circumstances under which I consulted Mr. Wheatstone, and the particulars of our earlier interviews, are thus stated:—

“While my four simpler mechanical instruments were being made, I employed myself in trying experiments upon the Electro-magnet, with a view to discover at what distance an electric current would excite the temporary magnetism required for moving the detent of the mechanism. For this purpose, I adjusted above a mile of wire in the chambers of Mr. Lane, in Lincoln's Inn; but the magnets and battery being ill-proportioned, my experiments were unsatisfactory. In this scientific difficulty I sought the assistance of Dr. Faraday, who advised me to increase the number of the plates of the battery proportionably to the length of the wires; an expedient which in some degree overcame the defects of the magnets. I also consulted Dr. Roget upon the same scientific point; explaining my motives, but without showing my instrument to him.

"Dr. Roget informed me that Professor Wheatstone had a quantity of wire at King's College, which might assist me in trying experiments upon the electro-magnet, and he advised me on that account to submit my difficulty to him. Using Dr. Roget's name as an introduction, I accordingly called the same day upon Professor Wheatstone at his residence in Conduit-street (on the 27th February 1837); on which occasion I asked his advice upon the point which I had before submitted to Dr. Faraday and Dr. Roget. In the course of conversation, Professor Wheatstone intimated that he had long been engaged in experiments himself, to show at what distances signals could be given by electricity, to be applied to telegraphic purposes. Upon his thus introducing the subject of a telegraph, I felt myself bound to caution him that my inquiry had reference to the same object, and that I was about to take out a patent for an Electric Telegraph.

"He politely invited me to King's College, where I found that in connexion with about four miles of wire, he was in the habit of using two galvanometers of different constructions, in his experiments on the effects of electric currents in deflecting magnetic needles. He had no apparatus of any kind for giving signals; but he had two key-boards, one of which was occasionally used in our experiments.

"What he had done towards inventing the Practical Electric Telegraph was confined to the "permutating principle" of his key-boards. This principle, which diminished the requisite number of wires, was engrafted on my Reciprocal Telegraph, and became very valuable in connexion with later improvements; but though diminishing the number of wires, the permutating keys by themselves, and without the later improvements, would have been more complex than my first galvanometer keys; for each of the latter gave two signals by a single needle (the plan now adopted on the Blackwall Railway), while the former required the concurrent action of at least two keys and two needles.

"Though Professor Wheatstone was, when I first consulted him, in possession of a valuable principle, he had gone no further. Except in the permutating principle, he was practically behind Möncke; for the latter had an instrument for giving signals, and Mr. Wheatstone had none. Even had all his apparent intentions been worked out, he would not then have fulfilled any of the fundamental conditions of the Practical Electric Telegraph;—the powers of detecting injuries to the wires, by fracture, water or contact; of attracting attention at the commencement of the communication; of sending signals alternately backwards and forwards by the same apparatus; and of exhibiting the signals to the operator, as well as to the recipient. In a word, he had no detector; no alarum; no reciprocal communicator."

The above mentioned interviews resulted in the formation of a partnership as follows:—

"Eventually, our partnership was formed at Mr. Lane's Chambers in Lincoln's Inn, early in May 1837; and Mr. Lane will prove that a very long discussion then took place between Mr. Wheatstone and myself as to money matters, and afterwards a very long discussion as to the priority of names in the patent. Mr. Wheatstone's own contemporaneous writing proves,

1st, That with his written consent my name took the lead.

2nd, That he paid £80 and I only £50 towards the expense of the patent: and other contemporaneous written evidence will show that any surplus was to be divided, not in these proportions but equally.

3rd, Mr. Wheatstone's own writing also proves that I was allowed £130 for past experiments.

"These are FACTS which cannot be disputed, whatever may be the effect of them. Professor Wheatstone was allowed *nothing* for his experiments; yet in the recent letter already quoted, he rests his claim to maintain his generally received position, as inventor of the Electric Telegraph, mainly upon the ground, that 'he alone, unaided, before he was acquainted with me, had carried into effect, *at a very considerable expense compared with his then limited means*, the extensive experiments on which all his subsequent researches have been founded.' His not having claimed anything for the expensive experiments which he had made before the commencement of our partnership, presents a striking contrast to his conduct at a later period; when having, in the year 1839, brought a particular series of experiments to a practically useful issue, he asked and obtained an allowance of £100 from the partnership for his expenses in those particular experiments, upon the express ground of the above original allowance to me; although at the time our legal agreement would have enabled me to refuse him any allowance."

The circumstances which immediately led to the arbitration are stated in the Case at considerable length. I extract the following passages.

*** "The present arbitration is the immediate offspring of Professor Wheatstone's rejection of a remonstrance admitted to be 'written with temper,' made by me to him, by a letter dated the 20th October last, against a paragraph which was widely circulated in several papers in that month. The paragraph contained an eye-witness's account of certain experiments exhibited by him at Brussels. It was headed, in some papers at least, 'Professor Wheatstone's Electrical Telegraph,' and without once intimating his connexion with a partner, ascribed to him the entire invention. The answer which I received was, that 'of the paragraphs' which had been so widely circulated that even comparative strangers had obtrusively called my attention to them, Professor Wheatstone 'knew nothing; they might be right or they might be wrong; but he had given them no sanction.'

"Some months previously, the fourth Report of the Select Committee on Railways, dated the 2nd July last, was publicly circulated. It was made in the course of an inquiry into those practical questions which had formed my exclusive department. It was made upon Professor Wheatstone's own evidence, some of which was given from information received by him from me, and at a time when he knew that at the request of Mr. Saunders, the Secretary of the Great Western Railway Company, I was waiting at the door of the Committee-room to give evidence if called in. I have no means of showing what his evidence really was, for it was corrected by him with the express view of removing any ground of complaint on my part, and the original notes cannot be obtained while Parliament is not sitting; but even as corrected and printed, the evidence is objectionable. Whatever were the words used by him, it is certain that his evidence conveyed to the mind of the Committee, some of whom were his personal acquaintances and had seen his experiments at King's College, a totally wrong impression, as appears by the following extract from the Report:—

'It appears, that on the Great Western Railway experiments have been made to a considerable extent, with the view of ascertaining the best means of conveying intelligence through the medium of electricity.

'Mr. Wheatstone, Professor of Experimental Philosophy in King's College, has for some years turned his attention to this subject, and has, in conjunction with Mr. Cooke, obtained patents for his inventions. From his evidence, which is especially deserving of notice, it appears that there is no difficulty in conveying intelligence to any part of the island with an almost instantaneous rapidity, by means of a few copper wires and small galvanic batteries. There is great ingenuity in the various modes in which Mr. Wheatstone has applied the power of electricity to alphabetical communication.'

"The impression embodied in the above Report existed at the time Professor Wheatstone gave his evidence, as appears by the first question put to the next witness, C. A. Saunders, Esq. viz.:—

'As the Secretary of the Great Western Railroad Company, can you state to the Committee whether they have adopted Mr. Wheatstone's Magnetic Telegraph?'

*** "About the time the Report of the Committee was made public, an article appeared in 'Chambers' Edinburgh Journal,' of the 25th July last, founded upon experiments which had been exhibited, and explanations which had been given to Mr. Chambers at King's College by Professor Wheatstone; and before the article appeared, Mr. Chambers had written to Mr. Wheatstone, as the latter himself told me, for additional information; but his letter was not answered, because Mr. Wheatstone thought he was going to publish. Here, then, is an article emanating immediately from Mr. Wheatstone's own experiments at King's College, exhibited and explained by himself to the author; an article very widely circulated, expressly upon his own authority, and not until after a written application for further information. Surely here I might have expected to find that Mr. Wheatstone gladly availed himself of an easy opportunity of correcting the misapprehensions which have been repeatedly brought under his notice. On perusing an article of four columns, in which my name is not once mentioned, nor the remotest hint given that Mr. Wheatstone has a partner, the Arbitrators will find it stated that he has now made the Electric Telegraph his own; that the first patent was effected by him alone; that he has now superseded it by the third patent, which is also represented to be his alone; that my detector, nay, even my modes of insulating and laying down the wires—my very application (the result of many a disappointment) of iron tubes—the entire invention and every part of it, are all attributed, without exception or qualification, to Mr. Wheatstone alone. * * *

* * * "I felt myself now peremptorily called upon to vindicate, without further delay, my connexion with the invention. * * * I did not charge him with having caused the reports of which I complained; but only brought again and finally under his notice his obligation to correct the mistaken impression, which (from whatever cause it had arisen) certainly existed, and was certainly injurious to me. I made use of the following expressions:—'Allow me to add, that however your erroneous position may have originated, you yourself become responsible for it when you decline to recede from it. A continued neglect to contradict misstatements which have been circulated in your favour, and by parties receiving their information personally from yourself, can only be construed as a voluntary retention and appropriation to yourself of what you know, and have repeatedly admitted, to belong to another in common with you; nor can it redound to the credit of your liberality if

you sanction, by your silence, even an unauthorized misapplication of your influence in the scientific world to repress and conceal the merits of a comparatively unknown colleague.' "

I began my extracts with a gentle and friendly remonstrance, addressed to Mr. Wheatstone before the arbitration was resorted to. I will conclude them with a specimen of my later protests against the efforts of his friends to explain away the Award. It is taken from a letter of the 16th January, 1845.

"It is now nearly two years since I remonstrated with you on the endeavours which your friends were making to undermine the award of Sir Isambard Brunel and Mr. Daniell, of April, 1841; but as these remonstrances were met by the assurance of your solicitor (made in your name and by your expressed desire) in his letter of the 20th May, 1843, that there was no truth in the report that you denied your full consent to the declarations contained in the printed paper — an assurance further confirmed by his letter of the 27th June, in these words; 'Mr. Wheatstone does not desire to escape from a single conclusion which the Award warrants;'—all I could do, was to express myself satisfied with an explanation so unqualified.

"The same cause of complaint has, however, been repeatedly obtruded upon me since. And I now hear from your own lips, that you have absolutely armed yourself with a letter from Mr. Daniell to counteract a certain construction of the Award, which you consider objectionable!

"This is indeed an alarming document to hold in reserve; and how Mr. Daniell could reconcile any such letter with the character of a Judge, remains to be explained."

I have never been permitted to look at this "alarming document;" but even if Professor Daniell did express himself incautiously in writing to his friend, no one acquainted with his manly and upright character can suppose that he intended to sanction a clandestine use of his letter to assist Professor Wheatstone's "escape" (in the words of his solicitor) "from a single conclusion which the Award warrants."

When Mr. Wheatstone has accounted for the priority of my name in the first patent, and for his own subscription to the Award, I shall be ready to discuss with him, *if he desires it*, our "shares," "priorities," and "relative degrees of merit" in the later developements of the invention. Confining myself for the present to the invention which was exhibited to the Arbitrators, and to the words of my original statement respecting it, I pass on to the business arrangements of 1843 and 1845.

Mr. Wheatstone has allowed his friends to speak of the arrangements of 1845, as if, retaining at that time his original half share of the patents, he had received less than half the consideration paid by the Electric Telegraph Company for the purchase of them. There is here what lawyers call a *suppressio veri;* the truth being, that in 1845 Mr. Wheatstone had no share in the patents at all, but only a royalty, which he then parted with at his own price.

His altered position in this respect was the result of the arrangement made in 1843, as already mentioned, by which I took the patents off his hands, releasing a claim which I had against his share, and granting him an ample royalty, without pecuniary responsibility, on all future telegraphs.

This new agreement was embodied in a deed, dated the 12th April, 1843, of which I will state the substance, curtailing legal verbiage.

After reciting the patents and the original partnership agreement, it goes on to say, that "the shares of the said C. Wheatstone in the - - - letters patent are subject to certain claims to a considerable amount, in favour of the said W. F. Cooke, for monies already advanced and paid by him - - - on account of the expenses of obtaining certain of the same letters patent and inrolling the specifications - - - and on other accounts."

Then follows a recital, that "it having been found that the complicated character of the aforesaid arrangements has tended to impede the successful prosecution of the said inventions, it was lately proposed and agreed - - - that all the letters patent, - - - and also all - - - patents for improvements - - - should be absolutely assigned - - - to the said W. F. Cooke; - - - and that in lieu of such interest of the said C. Wheatstone, - - - the said claims now affecting the same should be cancelled, and that there should be secured to him an allowance or royalty, in money, proportioned to the number of miles over which the said Electric Telegraph should be laid down by the said W. F. Cooke, his executors, administrators or assigns, or by or under licenses from the said W. F. Cooke, his executors, administrators or assigns."

The deed then "witnesseth" that "the said C. Wheatstone doth - - - assign - - - unto the said W. F. Cooke, his executors, administrators and assigns - - - the several letters patent - - - and all the privileges - - - thereby conferred, - - - and all the - - - shares - - - of him, the said C. Wheatstone, - - - in - - - the - - - letters patent - - - To the intent that the - - - letters patent - - - may be henceforth the sole property of the said W. F. Cooke, his executors, administrators and assigns - - - during all the residue of the respective terms of years granted by the same letters patent respectively, - - - and - - - during all extensions thereof. - - -

Further on in the deed I am bound, by pages of very stringent clauses, to account every January and July with Mr. Wheatstone for a royalty in his favour, on the operations on the preceding half-year, assessed at the following liberal rates:—

For the first ten miles of Telegraph completed during the year	£20 per mile.
For the second ten miles . .	£19 per mile.
For the third ten miles . .	£18 per mile.
For the fourth ten miles . .	£17 per mile.
For the fifth ten miles . . .	£16 per mile.
And for all beyond	£15 per mile.

The deed concludes with a release to Mr. Wheatstone of the balance due from him to me.

Passing on to the autumn of 1845, when the formation of the Electric Telegraph Company was in contemplation, Mr. Wheatstone then fixed his own terms for the sale of his royalty, and explained how he arrived at them, by the following letter :—

20, Conduit Street, August 2, 1845.

"My Dear Sir,

I have thought over your propositions, and after due consideration have arrived at the following conclusions. I will commute my royalty on *all* lines in England (and Wales) for the sum of £20,000, the royalty on lines completed before the payment of the first instalment of £10,000, to be paid to me under the present arrangement. The grounds of my calculation are these: 1st, that thirteen railway lines, averaging 100 miles each, would realize to me the above sum: 2ndly, that at the rate even at which lines have been completed during the first six months of the present year, the sum I have named would be realized in four, or at the utmost, five years: circumstances may augment or diminish this income, but I consider the chances of increase and decrease equal: 3rdly, that whatever arrangement be made for the sale of the Patents to other parties, the agreement with them cannot affect lines established previous to the date of such agreement.

If the Great Western Railway, and the portion of England south of this line and the Thames be excluded, I would fix the commutation at £16,000.

I will for a further sum of £10,000 give up all my rights in Scotland, Ireland, and Belgium, with all my reserved rights under the English Patents; or I will make a separate arrangement for any one or more of these privileges.

I wrote by last night's post to Mr. Quetelet, to ask when he leaves Brussels, and when he returns; if it be possible to arrive there a few days before he leaves I will start directly; but it will be of no use for me to be in Belgium when my most influential friend is absent.

Yours faithfully,
C. WHEATSTONE.

To W. F. Cooke, Esq.

P.S.—These propositions to be of no effect unless agreed to within a month from the present date.

C. W."

Some further correspondence took place on points of detail, but the terms themselves were in all points of substance agreed to as at first proposed in Mr. Wheatstone's letter. He received the £30,000 which he asked, together with all arrears of royalty.

But it has been said that the arrangements of 1845 precluded Mr. Wheatstone from continuing his important and meritorious telegraphic experiments. To this I answer, that both the deed of 1843, and the deed of 1845, bound Mr. Wheatstone very properly and reasonably—and bound him by almost the same words at each date—to give to the purchasers of the patents the benefit of all future improvements.

This usual clause, which in fact only sold with the patents a privilege which we have given away gratis, as a matter of course, to every railway company that has taken a licence, occurs in the deed of 1843, omitting technicalities, as follows—the same form being adopted in the deed of 1845, with a few immaterial verbal differences:—

> "The said Charles Wheatstone doth - - - covenant - - - with - - - the said Wm. F. Cooke - - - that if he - - - shall - - - during the - - - terms of any - - - of the - - scheduled Letters Patent invent - - - any improvement in or addition to the - - - inventions mentioned - - - in the - - scheduled letters patent - - - although such improvement or addition should have the effect of entirely superseding the - - - original invention - - - provided only that it be applicable to the giving, printing, stamping, or otherwise transmitting of signals, or the sounding of alarums, or the communication of intelligence wholly or partially by means or through the agency of electricity, magnetism, or electro-magnetism: In every such case the said Charles Wheatstone will - - - make a full and open disclosure thereof to the said William Fothergill Cooke - - - and will keep the same secret from all other persons - - - And will, upon the request and at the expense of the said W. F. Cooke - - - (the said Charles Wheatstone's expenses - - - being always allowed on a liberal scale) forthwith apply for - - - letters patent - - - in respect of - - - such improvement or addition: And - - - assign - - - such - - - letters patent unto the said William Fothergill Cooke, his executors, administrators, and assigns, as and for his and their absolute property."

But so far from prohibiting the exercise of Mr. Wheatstone's inventive talents, the promoters of the Electric Telegraph Company especially requested me to engage him as the Company's scientific adviser and assistant, on very liberal terms; and a memorandum to that effect was signed, and for a time acted on.

Mr. Wheatstone, however, soon resigned his appointment, under the following circumstances:—

A Bill for the incorporation of the Company, which was brought into Parliament in the session of 1846, was opposed by Mr. Alexander Bain, who asserted in his petition that he had invented an electric clock, and an electric printing telegraph, and had communicated his inventions confidentially to Mr. Wheatstone, and that the latter had claimed them as his own. The Directors carried their Bill, notwithstanding this opposition, though not without difficulty, through the House of Commons; but Mr. Bain's statement and evidence made such an impression in the House of Lords, that, in the afternoon of the third day of the sitting of the Lords' Committee, the Duke of Beaufort, as Chairman, intimated to the Company's counsel that the Committee were of opinion that the Company ought to make an arrangement with Mr. Bain—hinting, in fact, pretty plainly, that their Bill might be thrown out if they declined to do so. After a consultation with counsel, it was considered necessary to give way. Mr. Bain was accordingly bought off, and became associated with the Company, to the extreme displeasure of Mr. Wheatstone.

About the same time, the Directors unluckily made an agreement with a Mr. Henry Mapple, in ignorance that this person had a similar controversy with Mr. Wheatstone respecting an improved alarum and a telegraphic rope. As a member of the Board, I know that it was the sincere desire of the Directors to retain the benefit of Mr. Wheatstone's scientific assistance, or at any rate to avoid doing anything which could be personally disagreeable to him; but in consequence of the untoward circumstances above referred to, he sent in an account of his expenses and retired altogether from the Company's service.

I will assume that he had earned the £30,000 which he took away with him. But, *did he invent the Electric Telegraph?* The Award answers—No! and my forthcoming volume will show that the answer is not given on insufficient grounds.

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